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TACHIDIUS INCISIPES KLIE AND OTHER HARPACTICOIDS FROM NORTHWESTERN CANADA (CRUSTACEA: COPEPODA)

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Abstract.—Twelve species of harpacticoid copepods are reported from the shores of fresh and brackish lakes and ponds in northern Northwest Territories and Yukon Territory. *Attheyella ussuriensis* Rylov is a new record for North America and *Tachidius incisipes* Klie a new record for Canada.

The Southern Party of the Canadian Arctic Expedition 1913–1918 collected marine and freshwater Copepoda from localities between Vancouver Island, B.C. and Coronation Gulf, N.W.T. (Johansen 1922). Marsh (1920) and Johansen (1922) commented on the importance of Canadian Arctic Expedition collections as the first from a region that was little known in regard to micro-crustacean fauna. In their reports neither Johansen nor Marsh mentioned harpacticoid copepods, although both discussed species of calanoid and cyclopoid copepods. Willey (1920) recorded eight known species of harpacticoids and described an additional three as new to science; most were marine species but at least one was found in fresh-to-brackish water. Records for harpacticoids have lagged behind those for calanoids and cyclopoids although several investigations have added to the knowledge of freshwater copepods in the northern reaches of Yukon and Northwest Territories since the Canadian Arctic Expedition. The purpose of this paper is to furnish specific site records for several species of harpacticoids; two of which may be the first for Canadian waters.

Participation in an excursion to Yellowknife and Inuvik, N.W.T. following the XIXth Congress of the International Association of Limnology (SIL) in 1974, afforded me the opportunity to collect along margins of lakes and ponds.

Specimens were examined and dissected in glycerin or lactic acid (Humes & Gooding 1964). Insofar as possible, examination and drawings were made without cover slips.

Species were determined primarily by the key of Wilson & Yeatman (1959). Preliminary identifications were confirmed by comparing specimens with the descriptions found in Gurney (1932), Lang (1948), Borutzky (1952), and Dussart (1967).

Waters Sampled

Because the harpacticoid collections were opportunistic grab samples, there are few data on the waters sampled. Frame and Grace Lakes (Table 1) occupy rock basins with emergent vegetation in protected areas. Grace Lake is about 63 ha in surface and 9 m in mean depth (Brunskill, pers. comm. 1974). The Fort Franklin sample came from a pond about 0.1 ha in area and 20 cm deep in a muskeg at the edge of the village. This pond and the roadside ditch on the Hay River road at Yellowknife contained brown water and much vegetation.

The Tuktoyaktuk ponds are beach ponds in the sense of Johansen (1922), that is, they are only a little above sea level and situated quite close to the seashore but are not directly connected to the sea. These ponds undoubtedly receive Arctic Ocean water during onshore storm surge, as indicated by the presence of stranded driftwood. Meijer-

Table 1. Species of harpacticoid copepods collected from Northwest and Yukon Territories, 1974.

Locality	Coordinates	*Tachidius incisipes* Klie, 1913	*T. discipes* Giesbrecht, 1882	*Nitocra spinipes* Boeck, 1864	*Mesochra rapiens* (Schmeil, 1894)	*Atthyella nordenskioldii* (Lilljeborg, 1902)	*A. ussuriensis* Rylov, 1932	*Moraria duthiei* T. & A. Scott, 1896	*M. mrazeki* T. Scott, 1902	*Bryocamptus hutchinsoni* Kiefer, 1929	*B. vejdovskyi* (Mrazeki, 1893)	*Onychocamptus mohammed* (Blanchard & Richard, 1891)	*Halectinosoma* sp., *Pseudobradya* sp.?
Yellowknife, N.W.T.	62°30′N, 115°17′W												
Frame Lake				X					X				
Grace Lake						X							
Roadside ditch on Hay River road ca. 17 km northwest of Yellowknife										X			
Fort Franklin, N.W.T.	65°12′N, 123°25′W												
Small pond near village						X					X		
Inuvik, N.W.T.	68°21′N, 133°44′W												
Small pond near Campbell Creek on Dempster Highway							X						
Tuktoyaktuk	69°27′N, 133°2′W												
a. Beach pond		X	X		X							X	X
b. Beach pond				X								X	
c. Beach pond				X								X	
Shingle Point, Y.T.	68°56′N, 137°15′W												
Pond								X			X		

Table 2. Comparison of three species of *Tachidius*.

	T. discipes	*T. incisipes*	*T. spitzbergensis*
♀♀	antennule 7 articles	9 articles	7 articles
	antenna exp 2 setae	at least 5 setae	3 setae
	seg. 3, P1-4 5,6,6,5 spines & setae	5,6,5,5	5,6,5,5
	seg. 3 enp P-4 5,5,5,5	6,6,6,6	5,5,5,5
	P5 9 setae and spines	9	8
	anal operculum 12 or more spinules	several small spinules genital field with prominent U-shaped canal	smooth
♂♂		spinules lacking	spinules present
	spinules on chitinous ridge on antennule article 1	at least 5 setae	3 ?
	antenna exp 2 setae	P2 not modified	P2 modified
	P2 enp article 2 modified; article 3 with apical setae	less than 9, usually 7	6
	P5 5 to 8 usually 7 setae and spines	spinules	spinules
	anal operculum with spinules		

ing (1975) found electrical conductivity of 4776 and 2370 μSiemens in water from two Tuktoyaktuk ponds. Meijering and I likely sampled different ponds, although both sampled the same day.

Shingle Point is also on the coast of the Arctic Ocean; however, the pond sampled here lies on top of a low bluff above the beach and probably does not receive storm surge seawater.

Species Identified

Nine of 16 samples contained 12 species of harpacticoid copepods (Table 1). In the following accounts, N.W.T. and Y.T. forms that fell within descriptions provided by the above manuals are listed without comment.

Tachidiidae

Several males and females plainly referable to the genus *Tachidius* were collected from Tuktoyaktuk beach ponds (Table 1). The females were clearly *T. incisipes* on the basis of antennule of 9 articles, setae and spine formula of P1–P4 and U-shaped canal in the genital segment (Table 2).

The presence of a modified P2 indicated that the males were not *incisipes*. The close similarities of males of *discipes* and *spitzbergensis* are evident from Table 2. Olofsson (1917) noted the morphological closeness of male *discipes* and *spitzbergensis* and distinguished between them on the number of setae and spines on P5. Given the variability in the armament of P5 in *discipes* (Lang 1948, Dussart 1967) this does not seem a reliable characteristic. Lang (1948) synonomized *spitzbergensis* with *discipes*; however Wilson and Yeatman (1959) retained *spitzbergensis* in their key, using setation of P5 to separate the males and absence of spinules on the anal operculum of *spitzbergensis* to separate females. On the basis of setation of P5, the Tuktoyaktuk males were assigned to *T. discipes*.

Tachidius incisipes Klie, 1913

Seven females ranged in length from 0.75 to 0.82 mm. Metasome slightly flattened, widest at second thoracic segment. Rostrum small, pointed. Nuchal organ and lateral discs oval and discs present on all thoracic segments (Fig. 1). Genital field with U-shaped canal leading from genital pore to seminal receptacle (Fig. 2). Anal operculum with many spinules on free margin, row of fine spinules extending from oper-

culum base down each side. Caudal rami longer than broad (Fig. 3). Oblique row of spinules on dorsal and mesial surfaces, two dorsal setae set close together, outer caudal seta spine-like and about twice length of inner seta. Both medial setae jointed and having straight-sided basal sections which constrict abruptly, longer about 2.5 times the length of the shorter. Antennule of 9 segments (Fig. 4). Antenna of 4 segments, exopodite 2-segmented with a total of 5 setae (Fig. 5). Mandible with biramus palp, blade with one large blunt tooth and smaller teeth (Fig. 6). Outer surface with a process which Gurney (1932, fig. 403) depicted as a bump is clearly hook-like when seen in side view. Maxillule of two segments (Fig. 7) and maxilla of 3 endites, coxa-basis and an exopod, although segmentation not always distinct (Fig. 8). Maxilliped 3-segmented (Fig. 9), with a terminal claw.

Both rami of legs 1–4 of three articles, basopodites with prominent mounds densely fringed with long hairs, outer mound appearing to project between rami when legs are viewed anteriorly. P1 basipod spines large, article 3 of exopod with three spines and three setae, spines of exopod smooth (Fig. 10). P2 lateral spines of exopod articles 1 and 2, smooth; article 3, one marginal spine smooth and one toothed (Fig. 11), anterior face of endopod article 3 with two rows of spinules. P3 with prominent blade-like spinules on outer margin of exopodite segments and and article 2 of endopod, endopod article 3 with a total of six spines and setae (Fig. 12). P4 with rows of spinules on anterior face of all exopodite articles, endopod article 3 with a total of five spines and setae (Fig. 13). The numbers and arrangement of spines and setae agree with those given by Lang (1948:282). P5 a single plate with a total of eight spines and setae (Fig. 2).

Tachidius discipes Giesbrecht, 1882

The Tuktoyaktuk males were compatible with the specific characters as given by Oloffson (1917), Gurney (1932), Lang (1948), and Wilson & Yeatman (1959) in three regards: modified endopodite P2, antennule, and P5. The second segment of P2 endopodite of Tuktoyaktuk animals has a stout projection which overlaps a notch on segment three and bears two setae that are set close together at its inner distal angle (Fig. 14).

The first article of the antennule enlarged and bearing a rounded prominence, armed with small marginal spinules (Fig. 15). The inner lobe of P5 with 3 spines and the outer, 2 spines and 2 setae (Fig. 16).

The occurrence of a sample with two species of *Tachidius* each represented by one sex only may not be as strange as it appears at first view. Olofsson (1918) reported *T. longicornis* (= *T. incisipes*) and *T. spitzbergensis* occurring together in several samples from four lakes on Spitsbergen. Moreover, the numbers of each sex were often quite unequal. Seventeen individuals, all female, of *T. brevicornis* (= *T. discipes*) were found in one sample from a creek mouth at Bernard Harbour, N.W.T. (Willey 1920).

Atteyella (*Mrazekiella*) *ussuriensis* Rylov, 1932

Rylov (1932) described *Attheyella ussuriensis* from females collected in small puddle-like ponds on the shore of the Ussuri River near Khabarovsk (135°5′E, 48°30′N). Rylov did not find males and the species seems not to have been reported since the

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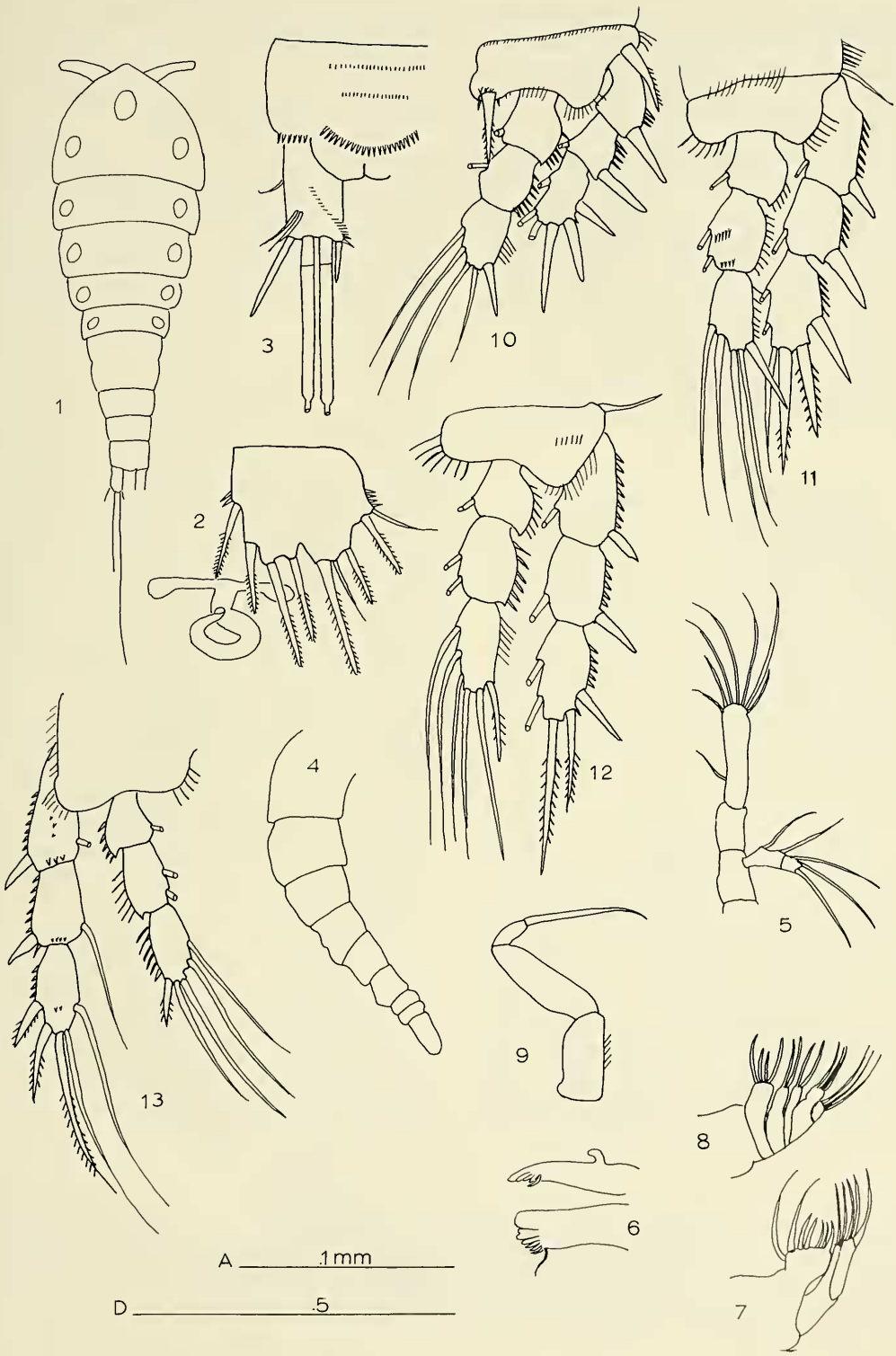
Figs. 1–15. Female *Tachidius incisipes*: 1, Habitus. 2, Genital field and P5. 3, Caudal ramus and anal operculum. 4, Antennule, setation omitted. 5, Antenna. 6, Mandible blade. 7, Maxillule. 8, Maxilla. 9, Maxilliped. 10, Pl. Feathering on setae omitted. 11, P2. 12, P3. 13, P4. Scale D: Fig. 1. Scale A: Figs. 2–13.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A .1 mm
D .5

original description, since both Lang (1948) and Borutzky (1952) used Rylov's figures.

One female was found in a collection from a pond at Campbell Creek near Inuvik. This female was readily identified in the keys of Lang and Borutzky and agreed with Rylov's description in regard to rami, enlarged base of caudal seta 2 (Fig. 17), form, size and number of teeth on the anal operculum (Fig. 17) and spines on P5 (Fig. 18). Rylov figured the spines of the basal article of P5 without sockets. This was also the case with the Campbell Creek female. Borutzky noted that the characteristic structure of P5 differentiates *ussuriensis* from all other species of *Attheyella.*

Moraria duthiei T. & A. Scott, 1896

One female was taken from a pond at Shingle Point (Table 1). Ramus with a dorsal chitinous ridge which terminated posteriorly in a sharp point (Fig. 19); anal operculum roughly triangular with a blunt point and eroded margin (Fig. 19); P5 exopodite jointed, feathering on setae sparse, some smooth (Fig. 20). This individual had a peculiar knob on the outer of the middle caudal setae (Fig. 19).

Bryocamptus (*Bryocamptus*) *hutchinsoni* Kiefer, 1929

A few specimens were collected from a roadside ditch near Yellowknife. These animals were like the typical form in possessing non-bifid spinules on the anal operculum and in characteristics of the ramus as given by Kiefer (1929) and Wilson & Yeatman (1959). A form in which the spinules are bifid occurs widely in Alaska, western Canada and western United States (Wilson & Yeatman 1959).

Bryocamputus (*Bryocamptus*) *vejdovskyi* (Mrazek, 1893)

Five males were collected at Fort Franklin and one male at Shingle Point (Table 1).

B. vejdovskyi is a member of the morphologically variable *minutus* group (Wilson 1956). In addition to sexual dimorphism there is geographical variation. Typical females possess only one well developed caudal seta, non-bifid anal operculum spines, the ramus terminates in a spinous process on its outer distal corner; males possess 3 well developed caudal seta, lack spinous process, and endopod P4 article 2 with 4 setae (Wilson & Yeatman 1959). Willey (1925) described as *Canthocamptus minusculus* a form in which the female lacked the spinous process on the outer, distal margin of the ramus. Willey had only four females, some of which had bifid operculum spines and some, simple spines. Willey believed *minusculus* to be the North American form of *Canthocamptus vejdovskyi* Mrazek (Willey 1925:157). Kiefer (1934) gave the name *Bryocamptus vejdovskyi* forma *minutiformis* to specimens with bifid anal operculum spinules, but which were otherwise typical *B. vejdovskyi* (Wilson & Yeatman 1959).

The Shingle Point male appeared to be typical *B. vejdovskyi* and had simple operculum spines (Fig. 21). This male possessed large teeth-like spines on the ventral surface of the last abdominal segment at the base of the caudal ramus; these spines were not mentioned by Lang (1948) or Wilson &

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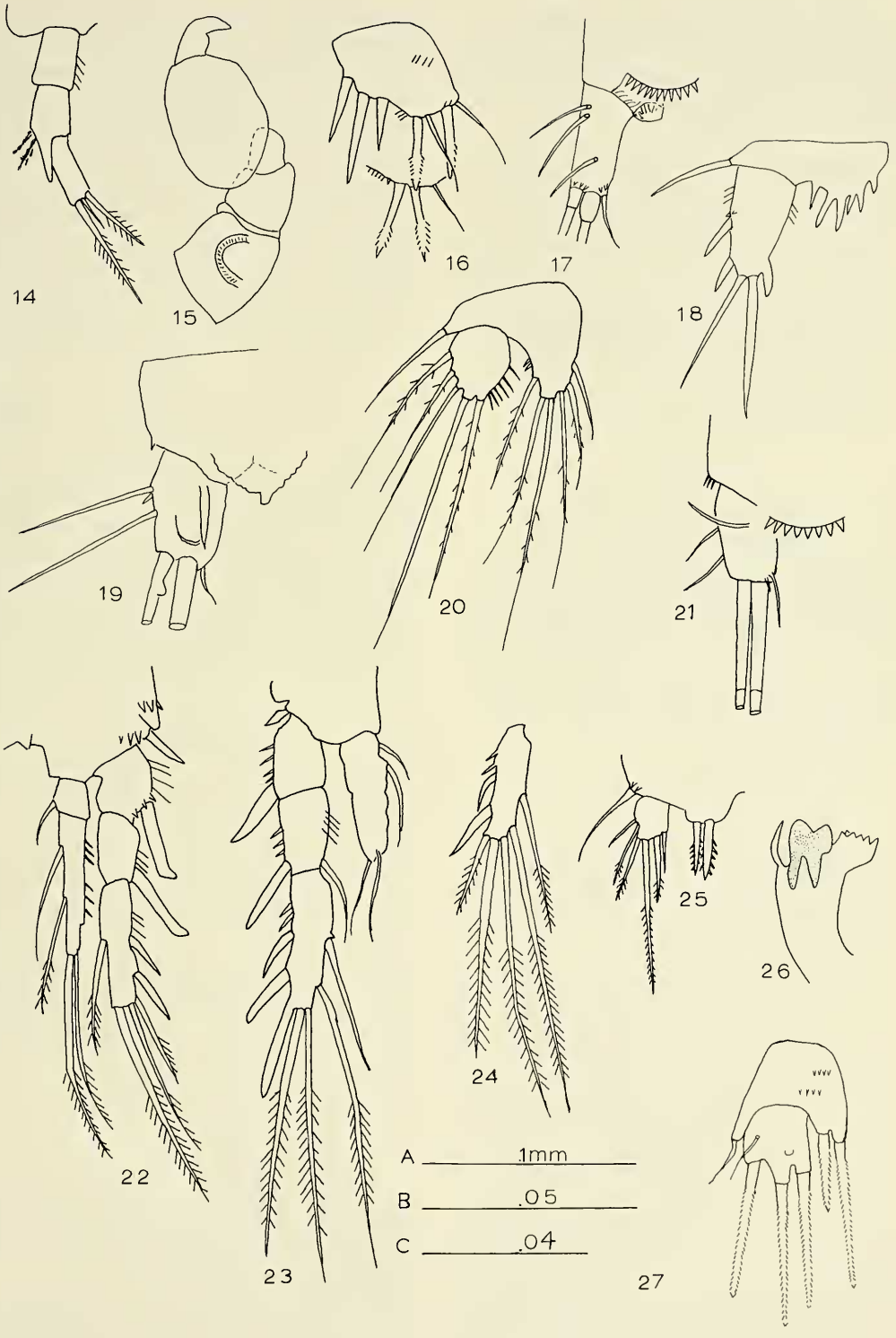
Figs. 16–27. Male *Tachidius discipes*: 14, Endopod P2. 15, Antennule. 16, P5 and P6. Female *Attheyella ussuriensis*: 17, Caudal ramus and anal operculum. 18, P5. Female *Moraria duthiei*: 19, Caudal ramus and operculum. 20, P5. Male *Bryocamptus vejdovskyi*: 21, Caudal ramus and anal operculum. 22, P2. 23, P3. 24, P4. 25, Female *Halectinosoma, Pseudobradya* sp.? 26, Mandible blade. 27, P5. Scale A: Figs. 14–18. Scale B: Figs 19 and 20. Scale C: Figs. 26 and 17.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26
27
A 1mm
B .05
C .04

Yeatman (1959). The Fort Franklin males differed from the Shingle Point male only in having bifid operculum spinules, resembling *B. v.* forma *minutiformis* in this character.

The large spines on the outer margins of exopodites of P2 (Fig. 22), P3 (Fig. 23) and the terminal article of P4 (Fig. 24) were completely smooth in the Shingle Point male. The terminal article of P2 endopodite (Fig. 22) and P5 of the Shingle Point male were similar to figures of these appendages in Lang (1948) except that the two spines on the inner lobe of P5 appeared relatively shorter and stouter (Fig. 25).

Laophontidae

Onchyocamptus mohammed (Blanchard & Richard, 1891)

Several males and females were collected from ponds a, b, and c, Tuktoyaktuk. Willey (1923) described as a new species, *Laophonte calamorum* from Lake St. John, Quebec. Lang (1948) regarded *L. calamorum* as a synonym of *O. mohammed.*

Ectinosomatidae

Halectinosoma?

The Tuktoyaktuk pond sample contained two female harpacticoids, 0.59 and 0.66 mm in length, that were clearly referable to Ectinosomatidae.

In addition to familial and generic features, the Shingle Point animals possessed these features: markedly conical caudal rami, length 1.5 and 1.8 times the width at base; abdominal segment of larger female densely covered both dorsally and ventrally with very tiny spinules; abdominal segment of smaller appeared covered with tiny pits. Hyaline lappets which project from the rear margin of the last abdominal segment over the bases of the caudal setae in many ectinosomatids could not be seen on either female. Both possessed a hyaline pseudooperculum with smooth margin. The larger female had an egg sac containing 6–8 fairly large ova.

Lang (1965) stated that the mandibles reveal useful specific characters in the genera *Ectinosoma* and *Halectinosoma.* The cutting edge of the mandibles of the Tuktoyaktuk females had a heavily sclerotized bidentate pars incisiva and six-dentate lacina (Fig. 26). All marginal setae of P5 stout and spine-like, the longest reaching to posterior margin of genital segment; surface setae inconspicuous; two rows of small spinules on anterior surface of basopodite (Fig. 27).

The maxillae were destroyed during dissection; the structure of this appendage would have permitted distinctions between *Halectinosoma* and *Pseudobradya.*

At least four species of Ectinosomatidae have been reported from coastal waters of N.W.T. and northern Alaska. The Canadian Arctic Expedition collected *Pseudobradya minor* (T. & A. Scott, 1896) and *Ectinosoma neglectum* Sars, 1904 at Bernard Harbour on Dolphin and Union Straits, N.W.T., and *E. finmarchicum* from Camden Bay, Collinson Point, Alaska (Willey 1920). Wilson (1973) identified *Pseudobradya major* (Olofsson, 1917) from Nuwuk Lake, a landlocked brackish water pond, Point Barrow, Alaska.

On the basis of characters of P5, caudal rami, antenna and other features, the Tuktoyaktuk females did not seem to conform to descriptions of ectinosomatids reported from northwestern coastal waters. Too little is known about these ectinosomatids to decide if they represent undescribed species; this must await more specimens.

Discussion

These records of *Bryocamptus vejdovskyi* extend the ranges of forms with bifid and simple opercular spines but do not clarify their relationship.

The harpacticoids taken at Tuktoyaktuk are members of genera with well-recognized euryhaline distributions (Lang 1948, Wil-

son & Yeatman 1959). *Bryocamptus hutchinsoni* appears to be known from North America only; otherwise, with the possible exception of *Attheyella ussuriensis,* the harpacticoids found in N.W.T. and Y.T. samples are species of wide geographical distribution particularly in the Palearctic and Nearctic Regions. Some species such as *Tachidius incisipes* and *Moraria duthiei* seem mostly northern in occurrence; others such as *Onychocamptus mohammed* and *Nitocra spinipes* extend into Africa and Asia Minor.

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Literature Cited

Borutzky, E. V. 1952. Fauna of U.S.S.R. Crustacea. Vol. 3. no. 4. Freshwater Harpacticoida. Zoological Institute, Academy of Sciences, Moscow, Israel Program of Scientific Translation, 1964.

Dussart, Bernard. 1967. Les Copepodes Des Eaux Continentales D'Europe Occidentale. Tome I: Calanoides et Harpacticoides. N. Boubee et Cie, Paris.

Gurney, Robert. 1932. British fresh-water Copepoda. Vol. 2. Ray Society, London, 336 pp.

Humes, A. G., & R. U. Gooding. 1964. A method for studying the external anatomy of copepods.—Crustaceana 6:238–240.

Johansen, Frits. 1922. The crustacean life of some arctic lagoons, lakes and ponds. Report of the Canadian Arctic Expedition 1913–18. Vol. VII. Part N. F. A. Acland, Ottawa, 25 pp.

Kiefer, Friedrich. 1929. Zur Kenntnis der freilebenden Copepoden Nordamerikas.—Zoologischer Anzeiger 86:97–100.

———. 1934. Neue Ruderfusskrebse aus Nordamerika.—Zoologischer Anzeiger 108:206–297.

Lang, Karl. 1948. Monographie der Harpacticiden. Hakan Ohlsson, Lund, 1682 pp.

———. 1965. Copepoda Harpacticoida from the California Pacific coast.—Kungliga Svenaka, Vetenskoppsahademiens Handlingar Series 4, 10(2): 1–560 + 6 pls.

Marsh, C. D. 1920. Freshwater Copepoda. Report of the Canadian Arctic Expedition 1913–18. Vol. VIII. Part J. J de Labroquerie Tache, Ottawa, 25 pp.

Meijering, M. P. D. 1975. Notes on the systematics and ecology of *Daphnia pulex* Leydig in northern Canada.—Internationale Revue der Gesamten Hydrobiologie und Hydrographie 60: 691–703.

Olofsson, Ossian. 1917. Beitrag zur Kenntnis der Harpacticiden—Familien Ectinosomidae, Canthocamptidae (Gen. *Maraenobiotus*) und Tachidiidae nebst Beschreibungen einiger neuen und wenig bekannten, arktischen Brackwasser-und Susswasser-Arten.—Zoologiska Bidrag fran Uppsala 6:1–39 + 7 pls.

———. 1918. Studien über die Susswasserfauna Spitzbergens.—Zoologiska Bidrag fran Uppsala 6:183–648.

Rylov, V. M. 1932. Resultats scientifigues de l'Expedition hydrofaunistique du Musee zoologique dans Siberia orientale en 1927. IV. Les Eucopepodes d'eau douce de la region de l'Oussauri (Crustacea). Travaux de L'Institute Zoologique, Leningrad, 1:248–280 + 6 pls.

Willey, A. A. 1920. Marine Copepoda. Report of the Canadian Arctic Expedition 1913–18. Vol. VIII. Part K. Thomas Mulvey, Ottawa, 47 pp.

———. 1923. Notes on the distribution of free-living Copepoda in Canadian waters.—Contributions to Canadian Biology and Fisheries. New Series I:303–334.

———. 1925. Northern Cyclopidae and Canthocamptidae.—Transactions of the Royal Society of Canada, 3rd Series, 19:137–158 + 3 pls.

Wilson, M. S. 1956. North American harpacticoid copepods. 1. Comments of the known freshwater species of the Canthocamptidae. 2. *Canthocamptus oregonensis* n. sp. from Oregon and California.—Transactions of the American Microscopical Society 75:290–307.

———. 1973. North American harpacticoid copepods 10. *Pseudobradya major* (Olofsson, 1917) n. comb. from Nuwuk Lake, Alaska, with a checklist of copepod associates.—Transactions American Microscopical Society 92:657–662.

———, & H. C. Yeatman. 1959. Harpacticoida. Pp. 815–861 *in* W. T. Edmondson, ed., Fresh-water biology. John Wiley & Sons, Inc., New York.

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